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DOCUMENT-IDENTIFIER: US 20020059645 A1
TITLE: Efficient rerording of object carousels

Abstract Paragraph:
A transmission system comprises a transmitter (10) and at least one receiver (14) configured to receive signals transmitted therefrom. Carousel-forming data file and directory objects are sent in cycles, with predetermined groups of file and directory objects being formed into respective modules at the transmitter, suitably according to MPEG-2 DSM-CC protocols. Each of the modules is transmitted as a whole, and the receiver is arranged to record received file data and directory objects under a predetermined grouping formulation, at elementary stream or module level.

Summary of Invention Paragraph:
[0002] A broadcaster can broadcast multimedia platform-specific applications possibly together with digital television programs. A suitably equipped multimedia platform-specific set-top box can receive those applications and run them locally. Example applications are electronic program guides, play-along games, Tele-banking, Tele-shopping, electronic newspapers and similar information services. Television programs can be recorded and, if such a television program has an application associated with it, then that application should also be recorded. Typically multimedia platform-specific applications are broadcast in an object carousel, where all the application code and data is broadcast in cycles. This resembles teletext data, which is also broadcast in a carousel.

Summary of Invention Paragraph:
[0004] As mentioned above, interactive multimedia applications are typically broadcast in a carousel-like fashion with successive data sections being repeated periodically and sequentially in the transport stream. For instance, both DVB and DAVIC have specified DSM-CC object carousels, as mentioned above, for broadcasting interactive applications.

Summary of Invention Paragraph:
[0005] As is described in the commonly-assigned International patent application WO 99/65230, the objects of a DSM-CC object carousel are broadcast in modules and provide a "virtual" file system comprised of file and directory objects in the manner of a personal computer (PC) file system. Such a module is a container of objects and comprises a number of DownloadDataBlock messages (which are specified in the MPEG-2 standard as private sections). When a set-top box wants to pre-fetch a DSM-CC object, it must (amongst other things) know in which module the object resides. After it has retrieved the right module, the set-top box must then parse the module to get to the object itself. Due to the hierarchical nature of the DSM-CC object carousel an object might be included in a subdirectory. If this is the case, the set-top box must also retrieve the module(s) with the intermediate directories, and parse them before it gets to the object in which it is interested.

Summary of Invention Paragraph:
[0006] Typically, the service provider will broadcast the object carousel in a compressed form. This compression is normally done at the module level. Thus,

retrieving an object requires also the decompression of all the modules that are needed for the retrieval of the objects the set-top box is interested in. As will be recognised, the hierarchical nature of the DSM-CC object carousel for the purpose of pre-fetching objects requires a lot of processing in the set-top box. Consequently, when considering the issue of recording as an adjunct to capture of digital video broadcasts, it will be recognised that there is a lack of an efficient way to record (and play-back) object carousels.

Summary of Invention Paragraph:
[0008] File and directory objects can change over time. In the DSM-CC object carousel, versioning is not done at the (file and directory) object level but at the module level. Only modules have version numbers. Even if only one object in a module changes, the complete module gets a new version number.

Summary of Invention Paragraph:
[0010] Since modules are broadcast in MPEG-2 transport streams, and each module is broadcast in the private data sections of an elementary stream, then typically a large number of modules will share the same elementary stream and a complete object carousel will generally be carried on only a limited number of elementary streams (typically fewer than 5).

Summary of Invention Paragraph:
[0011] As will be recognised by the skilled practitioner, the object carousel consists of three layers, wherein the top layer consists of the file and directory objects, the layer below that consists of modules, and the layer below that consists of private data sections in an elementary stream.

Summary of Invention Paragraph:
[0012] It is accordingly an object of the present invention to facilitate the recording of an multimedia platform-specific application, where it is necessary to record an object carousel (or a part of an object carousel), wherein the recording process can be managed such that the required storage space is minimal and such that the complexity is manageable.

Summary of Invention Paragraph:
[0013] In accordance with the present invention there is provided a transmission system comprising a transmitter and at least one receiver configured to receive signals transmitted therefrom, wherein carousel-forming data file and directory objects are sent in cycles with predetermined groups of file and directory objects being formed into respective modules at the transmitter, with each module being transmitted as a whole, and the receiver being arranged to store received file data and directory objects under a predetermined grouping formulation.

Summary of Invention Paragraph:
[0016] In a transmission system, or transmitter or receiver component thereof as recited above, the file and directory modules may be comprised in discrete data portions carried in an elementary data stream, with said predetermined grouping formulation for storage being at the elementary level. Alternately, the file and directory modules may be comprised in discrete data portions carried in an elementary data stream, with said predetermined grouping formulation for storage being at the module level. In either arrangement, the data including file and directory modules may further comprise a version indicator to identify updates, with said modules further comprising discrete data portions carried in an elementary data stream, with said predetermined grouping formulation for storage being at the elementary level.

Summary of Invention Paragraph:
[0017] In a transmission system, or transmitter or receiver component thereof, as described above, the file and directory modules may be linked to time stamp data, with the transmitter being configured to include such time stamp data and the

receiver component being arranged to recover such time stamps and utilise them in the reproduction from storage of the carousel. With such a configuration, the reproduction from storage of the carousel is suitably performed at data rates other than that indicated by said time stamps. In one particular application of this latter feature, the reproduction from storage of the carousel is suitably performed at data rates greater than that indicated by said time stamps (i.e. trick modes such as fast forward are accommodated) by reproducing carousel data at a data rate indicated by time stamp data and selectively interposing additional copies of reproduced carousel file and directory objects with said originally reproduced copies.

Brief Description of Drawings Paragraph:
[0021] FIG. 2 shows schematically the layering used in DSM-CC object carousels;

Brief Description of Drawings Paragraph:
[0023] FIG. 4 schematically illustrates two options for increasing bit rates during playback of carousel data.

Detail Description Paragraph:
[0026] A set-top box can 14 tune to a specific transport stream 12 and is then able to retrieve information from the transport stream 12. Such a set-top box 14 typically has only one tuner and is thus merely able to receive a single transport stream 12 at a time. When a user wants to look at a television program, or wants to run an interactive application, or wants to access other kinds of data the set-top box 14 tunes to the corresponding transport stream 12 and retrieves and/or processes the required data from the service as it is being broadcast at that moment.

Detail Description Paragraph:
[0027] Interactive applications such as Tele-banking, Tele-shopping or information services are typically broadcast in a carousel-like fashion, i.e. the therewith corresponding data sections are repeated periodically in the transport stream 12. For instance, both DVB and DAVIC have specified DSM-CC object carousels for broadcasting interactive applications.

Detail Description Paragraph:
[0028] In FIG. 2 the layered structure of DSM-CC object carousels is shown. The objects of a DSM-CC object carousel are broadcast in modules. Such a module is a container of objects and comprises a number of DownloadDataBlock messages (which are MPEG-2 private sections). In FIG. 2 module 42 comprises the objects 32, 36 and 40. These objects are included in so-called BIOP-messages. In such a BIOP-message the object is preceded by a message header. In FIG. 2 a first BIOP-message comprises a message header 30 and the object 32, which object 32 may include directory information. A second BIOP-message comprises a message header 34 and the object 36, which object 36 may include stream information. A third BIOP-message comprises a message header 38 and the object 40, which object 40 may include file information.

Detail Description Paragraph:
[0030] Based on the layering of the object carousel, the recording of the object carousel can be done on each of the three layers. Recording at the top layer means that the files and directories of an application are stored in a (regular) file system. This would be a simple solution for object carousels that are static. If however the contents of the object carousel change, then the administration to keep track of file and directory versions becomes extremely complex, because the versioning in the carousel is not done at the file and directory level, but at the module level. An advantage of this solution is that files and directories can be provided to the application on demand without the carousel latency. However, because of the versioning problem, this solution is not preferred.

Detail Description Paragraph:
[0031] In one preferred arrangement, the recording of the object carousel is undertaken at the elementary stream level. Recording at the elementary stream level has the advantage that it is generally simple and independent of the specifics of the object carousel. The drawback of this solution is however that of the costs in terms of storage capacity, because each cycle of the carousel is stored over and over again. If much of the carousel content does not change between cycles, then the recording will contain a notable amount of redundancy.

Detail Description Paragraph:
[0032] In a further preferred arrangement, the recording of an object carousel is undertaken at the module level. One advantage of this solution is that only one instance of a version of a module can be recorded, which results in a significant reduction of required storage capacity. This ties in to the arrangement described below with reference to FIG. 3 which represents how one specific version of a module is only valid during a specific interval in relation to a recording R. For example, during a recording a module M can have three versions M1, M2, M3. The first version is valid from time=0 (the beginning of the recording) to time t1, the second from t1 to t2 and the third from t2 to t3 (the end of the recording). The recording must store all three versions M1-3 of the module together with an indication for the interval in which they are valid.

Detail Description Paragraph:
[0033] The capture and storage of carousel component modules at the elementary stream or module level further assists the efficient play back of an application by providing the modules to the application on demand, especially when the device that contains the recorded modules is a different device from the one that runs or will run the recorded application. That is, the object carousel is not reconstructed during playback (although that certainly is a valid option), but a module is only sent to the multimedia platform-specific device when the multimedia platform-specific device explicitly asks for a module. This has the advantage that the multimedia platform specific device observes a minimal latency when acquiring a module. This typically gives a significant performance improvement compared to a live object carousel broadcast or compared to the situation where the storage device reconstructs the object carousel during play back.

Detail Description Paragraph:
[0035] Providing modules on demand, as described above, requires a special interface between the multimedia platform-specific device and the storage device. The multimedia platform-specific device may not have such an interface and it may only expect a (partial) transport stream input. In that case, the storage device has to reconstruct the object carousel. Because the performance of the application may depend on the order in which the modules are being transmitted, and the broadcaster has probably put the modules in a performance-wise optimal order, it is useful to send out the modules with the same relative timestamps as in the original broadcast. The device supports the recording of the (relative) time stamps of transmission of each module that is part of the recording and the usage of these time stamps in the reconstruction of the object carousel. The time stamps can be stored as a list of tuples (time, module, version). This storage is in addition to the storage of the modules itself (one copy for each version of the module).

Detail Description Paragraph:
[0036] As a further feature the play-out of a versioned file system (object carousel) may be undertaken at a higher bit rate than originally broadcast. This might be done as schematically represented in FIG. 4 by playing out (middle trace PB.1) the same sequence of modules M4, M5, M6 faster than they were recorded (upper trace REC). Alternately, the bit rate increase may be achieved by keeping the original timing of modules intact and then injecting repetitions of some or all modules in between the play-out of the modules on the original time scheme (lower trace PB.2). Playing out with a higher bit rate will generally be possible, because

the available bandwidth from the storage device to the multimedia platform-specific device will tend to be higher than from the broadcaster to the home.

Detail Description Paragraph:
[0038] From reading the present disclosure, other modifications will be apparent to persons skilled in the art. For example, the extraction of a versioned file system from an object carousel (or any other form of data broadcast) may be undertaken as precursor to storing it "out of band". The reasons for this are improved disc usage (less storage space needed) and faster random access. This and other such modifications may involve other features which are already known in the design, manufacture and use of multimedia home platforms and applications and devices for incorporation therein and which may be used instead of or in addition to features already described herein.

CLAIMS:

1. A transmission system comprising a transmitter and at least one receiver configured to receive signals transmitted therefrom, wherein carousel-forming data file and directory objects are sent in cycles with predetermined groups of file and directory objects being formed into respective modules at the transmitter, with each module being transmitted as a whole, and the receiver being arranged to store received file data and directory objects under a predetermined grouping formulation.

6. A transmission system according to claim 1, wherein the data including file and directory modules further comprises a version indicator to identify updates, with said modules further comprising discrete data portions carried in an elementary data stream, with said predetermined grouping formulation for storage being at the elementary level.

7. A transmission system according to claim 1, wherein the file and directory modules are linked to time stamp data, with the transmitter being configured to include such time stamp data and the receiver component being arranged to recover such time stamps and utilise them in the reproduction from storage of the carousel.

8. A transmission system according to claim 7, wherein the reproduction from storage of the carousel is performed at data rates other than that indicated by said time stamps.

9. A transmission system according to claim 8, wherein the reproduction from storage of the carousel is performed at data rates greater than that indicated by said time stamps by reproducing carousel data at a data rate indicated by time stamp data and selectively interposing additional copies of reproduced carousel file and directory objects with said originally reproduced copies.

12. A transmitter according to claim 2, wherein the data including file and directory modules further comprises a version indicator to identify updates, with said modules further comprising discrete data portions carried in an elementary data stream, with said predetermined grouping formulation for storage being at the elementary level.

13. A transmitter according to claim 2, wherein the file and directory modules are linked to time stamp data, with the transmitter being configured to include such time stamp data and the receiver component being arranged to recover such time stamps and utilise them in the reproduction from storage of the carousel.

14. A transmitter according to claim 13, wherein the reproduction from storage of the carousel is performed at data rates other than that indicated by said time stamps.

15. A transmitter according to claim 14, wherein the reproduction from storage of the carousel is performed at data rates greater than that indicated by said time stamps by reproducing carousel data at a data rate indicated by time stamp data and selectively interposing additional copies of reproduced carousel file and directory objects with said originally reproduced copies.

18. A receiver according to claim 3, wherein the data including file and directory modules further comprises a version indicator to identify updates, with said modules further comprising discrete data portions carried in an elementary data stream, with said predetermined grouping formulation for storage being at the elementary level.

19. A receiver according to claim 3, wherein the file and directory modules are linked to time stamp data, with the transmitter being configured to include such time stamp data and the receiver component being arranged to recover such time stamps and utilise them in the reproduction from storage of the carousel.

20. A receiver according to claim 19, wherein the reproduction from storage of the carousel is performed at data rates other than that indicated by said time stamps.

21. A receiver according to claim 20, wherein the reproduction from storage of the carousel is performed at data rates greater than that indicated by said time stamps by reproducing carousel data at a data rate indicated by time stamp data and selectively interposing additional copies of reproduced carousel file and directory objects with said originally reproduced copies.

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